

REMARKS

Reconsideration and allowance of this application is respectfully requested. Applicants submit that in view of the arguments set forth herein, this application is in condition for allowance and such action is earnestly requested. The Examiner's reasons for rejection are addressed below.

Section 103 rejection

Claims 1, 4-7, 9-13, 15-16 and 20-37 stand rejected under 35 U.S.C. §103(a) over various combinations of U.S. Patent No 6,432,821 to Dubin et al. ("Dubin '821"), as evidenced by U.S. Patent Publication No. 2002/0061715 to Uzoh et al. ("Uzoh"), and U.S. Patent No. 5,972,192 to Dubin et al. ("Dubin '192"). With regards to independent Claims 1, 9 and 15, the Examiner has found that Dubin '821 teaches all of the limitations of the claims with the exception of "the second anodic current waveform has a longer duration than the first anodic current waveform." However, the Examiner has found that Dubin '821 allegedly teaches that "the current densities and length of times for each forward or reverse plating step can be varied," and that "it would have been obvious to one of ordinary skill in the art...to choose a second anodic current waveform having a longer duration than a first anodic current...so that the process as a whole provides a reduction or elimination of voids."

Applicants respectfully disagree with the Examiner's reasons for rejection. In essence, the Examiner asserts that the general sequence of pulses (cathodic/ anodic/ cathodic/ anodic) is taught by Dubin '821, and that the pulse durations can be modified. These teachings are not specific enough to suggest modulating relative durations of the two anodic pulses at all, much less conclude that the second anodic current pulse should be longer than the first anodic current pulse. It is notable that Dubin '821 shows identical anodic pulse durations and contains no suggestion to stray from that while varying pulse durations.

Dubin '821 merely teaches that "[t]he current densities and length of times for each step of the electroplating operation are chosen so that the process *as a whole* provides a reduction or elimination of voids when filling small openings in an interlayer dielectric film," aside from the hindsight benefit of Applicants' invention, which is forbidden from use, there is no teaching or suggestion in Dubin '821 that would lead the skilled artisan to modify or modulate the relative durations of the *two recited anodic current pulses* in the particular manner recited in Claims 1, 9

and 15. None of the references the Examiner has cited recognize relative durations of the anodic current waveforms as “result-effective” variables for avoiding void formation. Further, while the Examiner points to col. 6, lines 42-46 as supporting his position that the “length of times” can be varied, in fact, that section merely states that the densities and durations are chosen to avoid elimination of voids.

This statement relates to all the pulses in general and does not recognize durations of two *anodic* pulses relative to one another to be a variable to vary in order to minimize void formation. The mere suggestion that durations can be varied does not amount to a particular suggestion to perform the particular relative durations recited in the claims. That is, Dubin ‘821 does not teach or suggest modifying the relative durations of the anodic current pulses in a manner such that “the second anodic current waveform has a longer duration than the first anodic current waveform,” as recited in Claims 1, 9 and 15. Note that varying pulse durations in general is consistent with increasing or decreasing all anodic pulses together.

In contrast, Applicants teach that lengthening the successive pulses lends advantages in filling cavities. In particular, accelerator concentrations are reduced by the recited anodic pulses, leading to greater flatness for deposition over structures like that of Applicants’ Figure 3.

Consequently, the combination of Dubin ‘821 and Uzoh does not teach or suggest the particular recitations of Claims 1, 9 and 15, and Applicants respectfully request that the §103 rejection of Claims 1, 9 and 15 be withdrawn.

Claims 4-7, 10-13, 16 and 20-37 depend from and therefore include all of the limitations of Claims 1, 9 and 15, in addition to reciting features of particular advantage and utility. The combination of Dubin ‘821 and Uzoh does not teach all of the limitations of Claims 1, 9 and 15, let alone the unique combination of limitations of Claims 4-7, 10-13, 16 and 20-37. Accordingly, Applicants respectfully request that the §103 rejection of Claims 4-7, 10-13, 16 and 20-37 also be withdrawn.

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CONCLUSION

In view of the foregoing amendments and remarks, Applicants respectfully submit that this application is in condition for allowance and request the same. If there is any further hindrance to allowance of the pending claims, the Examiner is invited to contact the undersigned.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

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